Plug and Play Components for Building Integrated PV Systems

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OVERVIEW

Schott Applied Power Corporation is developing innovative new products to facilitate the broad use of its PV systems in the current markets. A major focus of this effort has been the development of the new FS system for mounting large PV arrays on flat-roof buildings. The company's new and patent-protected penetration-less FS mounting system was wind-tunnel tested at the Massachusetts Institute of Technology, achieved its design and performance goals and was introduced in late 2002. Other products planned for 2003 include a new line of combiner boxes in the company's PV systems, and a novel, patent-protected interconnection device for residential PV installations. These developments are all made possible by the NREL PVMaT program.

1. Introduction

The company has many years of experience designing PV arrays and installing them on flat-roofs and pitched roofs, and had plans to improve these designs. Specifically, wind-tunnel testing and analysis was needed for the new flat-roof PV array mounting system that avoids roof penetrations. In addition, in order to simplify large grid-tied PV systems for flat-roof applications, the company's line of wiring junction boxes needed to be updated with new components and higher-power multi-circuit configurations. For pitched-roof residential applications, testing was planned to determine the holding power of three different fasteners in a wide range of wood sheathing types found in residential construction, to help optimize fastening methods. A device for connecting PV to the grid at a meter socket was innovated and is also being developed.

2. The SAPC FS Mounting System

The FS mounting system is the new signature PV system of the company for flat roof buildings. The primary goal for the FS mounting system was that it not require any penetrations of the building for anchoring, and that it be able to withstand design wind forces for the majority of sites in the U.S. This challenging goal was achieved through the work completed under the PVMaT program. Attributes of the new FS system include:

- Open design, allowing ambient air to circulate freely around and under the PV modules to the benefit of module efficiency and lifetime
- Integrated design with junction boxes that mount directly to supports
- Durable materials; all hardware and fasteners are stainless steel or aluminum for long trouble-free life
- 5-degree PV array tilt angle to promote self cleaning of the modules in rain, yet allow high packing density of PV on a given roof space.
- Adaptable to a variety of PV modules including the ASE-300 and typical 150-Watt modules from other manufacturers.
- Verified and documented wind performance including wind tunnel testing at the Wright Brothers Wind Tunnel on the campus of the Massachusetts Institute of Technology up to 110mph. Significant computational fluid dynamic modeling to replicate wind forces on full-sized arrays on buildings and to study effects of parapets, wind direction, array geometry and location relative to building, and other parameters.
- Low weight, less than 3.5 pounds per square foot for an installed array
- Low materials and installation costs
- Easy access to all modules for inspection

Fig. 1. FS system lower RoofJack and base plate

Fig.2. A completed 60kW FS system in Sonoma, CA

The FS system incorporates a feature whereby the lower support can auto-adjust in response to extreme wind forces, allowing the modules to achieve a wind-relieving shallower, near-horizontal tilt angle.

3. Combiner Boxes

All PV arrays require some form of junction box that allows source circuits to be combined and wiring protected from over-current. The company currently manufactures a UL-listed junction box that is being updated to utilize new components. In addition several new versions are under development to accommodate wiring of larger arrays with multiple higher current circuits. This subarray combiner is being designed to integrate mechanically and electrically with the wiring and mounting elements of the FS systems. The new integrated combiner boxes will make wiring faster, easier and systems lower in cost.

Schott Applied Power also distributes residential PV system kits that are assembled, packaged and shipped from the company's Rocklin, CA headquarters. New versions of smaller, simplified junction boxes are under development for introduction in these kits later this year.

Fig. 3. UL listed junction box

4. Additional Activities

The company has three additional development activities underway in the PVMaT program. The first of these was to conduct testing of the pull-out strength of fasteners in plywood decks of varying types and thicknesses, representative of practices around the country. Results of this testing led to the reduction in fasteners used with the company's RoofJack mounting brackets for pitched residential rooftop PV installations.

The second activity is to develop a version of the company's RoofJack mounting brackets for steeply-pitched roofs typical of those found in older construction in the Northeast.

The third activity is to develop the device for interconnecting PV systems to the grid in a simplified manner. This product is patent pending.

5. Conclusions

The PV systems from Schott Applied Power Corporation will feature these new products and features during the coming year, to help make our systems easier to install, lower in cost and broadly applicable in the marketplace.